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TITLE : CERAMIC COMPOSITION AND PIEZOELECTRIC TRANSFORMER MADE THEREOF

ABSTRACT : PROBLEM TO BE SOLVED: To obtain a ceramic composition sinterable at relatively low temperatures, having both piezoelectric characteristics and practical transformer characteristics favorable for piezoelectric transformers, also enabling more inexpensive Ag-Pd as an internal electrode material to be utilized.

SOLUTION: This ceramic composition comprises the fundamental component of the general formula: $Pb((Mn_{1/3}Nb_{2/3})a(Co_{1/2}W_{1/2})bZrcTid)O_3$ (a+b+c=1) (wherein $0.03 \leq (a) \leq 0.09$, $0.06 \leq (b) \leq 0.12$, and $(a+b) \leq 0.18$).

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(54) CERAMIC COMPOSITION AND PIEZOELECTRIC TRANSFORMER MADE THEREOF

(57)Abstract:
PROBLEM TO BE SOLVED: To obtain a ceramic composition sinterable at relatively low temperatures, having both piezoelectric characteristics and practical transformer characteristics favorable for piezoelectric transformers, also enabling more inexpensive Ag-Pd as an internal electrode material to be utilized.

SOLUTION: This ceramic composition comprises the fundamental component of the general formula: Pb((Mn1/3Nb2/3)a(Co1/2W1/2)bZrcTid)O3 (a+b+c=1) (wherein 0.03)<=0.09, 0.06<=(b)<=0.12, and (a+b)<=0.18).

CLAIMS

[Claim(s)]
[Claim 1] General formula Pb (Mn1/3Nb 2/3) (a(Co1/2W1/2) bZrcTid) Porcelain constituent which is 0.03<=a<=0.09, and is 0.06<=b<=0.12 in the fundamental component of O3 and (a+b+c+d=1), and becomes a+b<=0.18 further.
[Claim 2] The piezoelectric transformer which consists of a porcelain constituent according to claim 1.
[Claim 3] A piezoelectric transformer according to claim 2 is a piezoelectric transformer characterized by being a laminating mold.
[Claim 4] The piezoelectric transformer characterized by using Ag-Pd for an electrode in the piezoelectric transformer of claim 2 and three publications.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the porcelain (ceramics) constituent of the PZT system which demonstrates many outstanding properties, such as a piezo-electric property. It is related with the porcelain constituent which enabled sintering at low temperature suitable as an object for the piezoelectric transformers of a laminating mold especially. Moreover, it is related with the piezoelectric transformer which consists of such a porcelain constituent.
[0002]
[Description of the Prior Art] The conventional technique about the piezoelectric ceramics used for a piezoelectric transformer is explained. compared with a coil transformer, a pressure-up ratio is large, and the piezoelectric transformer which carries out adjustable [of the electrical potential difference] using the resonance phenomena of a piezoelectric device can perform small lightweight-ization, and is incombustibility -- etc. -- research has been done from the reason more briskly than the Showa 50s.
[0003] It was desired for k of a piezoelectric transformer which shows the conversion efficiency of mechanical Q (= Qm) and the electrical and electric equipment which are a piezoelectric constant, and a machine to be comparatively larger than the principle type.
[0004]
[Problem(s) to be Solved by the Invention] In order for the pressure-up ratio of a piezoelectric transformer to be greatly influenced by the thickness of the input section and to improve this, it is necessary to laminate a piezoelectric transformer. In this case, the high electrode material of cost must be used, so that the approach of really sintering the electrode which consists of noble metals is common to the interior of the ceramics and sintering temperature is high.
[0005] However, in the old presentation patent, the burning temperature at the time of this baking is 1100 degrees C or more, and almost all presentations need baking by the temperature around 1200 degrees C in fact. Therefore, it was only expensive noble metals which can be used as an electrode material, such as Pd and Pt, and use of cheaper Ag-Pd was difficult.
[0006] This invention has piezo-electric many properties suitable as a piezoelectric transformer, and an actual transformer property, and aims at offering the porcelain constituent which can do low temperature sintering which enabled use of still cheaper Ag-Pd as an internal electrode ingredient.

[0007]
[The means for solving a technical problem, and its operation and effectiveness] In the fundamental component of general formula Pb(Mn1/3Nb 2/3) (a(Co1/2W1/2) bZrcTid) O3 and (a+b+c+d=1), this invention made in order to solve the above-mentioned technical problem is 0.03<=a<=0.09, and is 0.06<=b<=0.12, and was used as the porcelain constituent which becomes a+b<=0.18 further.
[0008] In case burning temperature can be lowered to 950 degrees C - 1150 degrees C and it uses as a piezoelectric transformer with the above-mentioned constituent, Ag-Pd cheap as an electrode can be used.
[0009] In the desirable gestalt of this invention, it is making it a laminating mold as a piezoelectric transformer.
[0010]
[Embodiment of the Invention] In order to clarify further a configuration and an operation of this invention explained above, the suitable example of this invention is explained below. [0011] General formula Pb (Mn1/3Nb 2/3) (a(Co1/2W1/2) bZrcTid) The constituent made to express with O3 is created in the following procedures.
[0012] A start raw material is the oxide and carbonation object of 99% or more of purity, and weighing capacity is carried out at a rate of the appointed empirical formula. After grinding mixing is carried out by one by wet [by a ball mill etc.], a mortar, etc. of dry-type approaches, at the temperature of 800 degrees C - 900 degrees C, temporary quenching of the raw material by which weighing capacity was carried out is carried out, and it is ground again and is once created.

[0013] then, a monolayer article -- being related -- a binder -- 3wt(s)% -- it adds and fabricates by the pressure of 500-1000kg/cm2 in predetermined magnitude. Moreover, after printing an internal electrode to a predetermined pattern after fabricating in the shape of a sheet by the extrusion-molding method, the doctor blade fabricating method, etc. by adding a binder 5 to 10% about a laminate, and carrying out a sticking-by-pressure laminating by the pressure of 10-100kg/cm2, it cuts in a predetermined dimension.
[0014] The process after this is common to a monolayer article and a laminate, first, degreases at the temperature of 600 degrees C, and is further calcinated at the temperature of 950 degrees C - 1150 degrees C for 0.5 to 3.0 hours.

[0015] After a burned product forms Ag baking electrode outside, it impresses the electrical potential difference of 1.0kV/mm - 3.0kV/mm at the temperature of 100 degrees C - 150 degrees C for 0.3 to 2.0 hours, and performs polarization processing. About evaluation, the impedance analyzer estimated the usual piezoelectric constant based on electronic ingredient Semiconductor Equipment & Materials International specification (EMAS).
[0016] If attached to the output voltage of a piezoelectric transformer, the electrical potential difference generated in the output side electrode at the time of adding the sine wave of 10V in resonance frequency to an input lateral electrode was measured and evaluated using the 28x7.5x2mm transformer component.

[0017] About burning temperature, the bulk density after baking chose the temperature used as max. A cheaper internal electrode material can be used as it becomes low about burning temperature. That is, although only Pt can be used from the problem of the melting point of the noble metals if attached to a temperature field 1250 degrees C or more, it becomes possible to use the cheap compost of Ag and Pd in a temperature field 1150 degrees C or less.
[0018] The chart of the property of each presentation in this invention and the property of a comparison presentation is shown in Table 1.
[0019]
[Table 1]

	焼成温度(℃)	a	b	C	d	kp	Qm	出力電圧(V)
比較例1	1250	0.00	0.03	0.47	0.50	25	46	−
比較例2	1250	0.03	0.03	0.45	0.49	32	215	−
比較例3	1250	0.06	0.03	0.44	0.47	40	533	1650
比較例4	1250	0.09	0.03	0.42	0.46	49	1200	2500
比較例5	1200	0.12	0.03	0.40	0.45	38	1800	850
比較例6	1150	0.00	0.06	0.45	0.49	30	12	−
実施例1	1150	0.03	0.06	0.44	0.47	45	1250	2850
実施例2	1150	0.06	0.06	0.42	0.46	47	1300	2950
実施例3	1150	0.09	0.06	0.41	0.44	50	1100	2650
比較例7	1150	0.12	0.06	0.40	0.42	35	1550	1000
比較例8	1100	0.00	0.09	0.44	0.47	46	32	750
実施例4	1100	0.03	0.09	0.42	0.46	49	1120	2850
実施例5	1050	0.06	0.09	0.41	0.44	55	1800	3650
実施例6	1050	0.09	0.09	0.39	0.42	51	1250	2650
比較例9	1000	0.12	0.09	0.38	0.40	15	1500	−
比較例10	1000	0.00	0.12	0.43	0.45	42	56	−
実施例7	1000	0.03	0.12	0.41	0.44	46	46	2950
実施例8	950	0.06	0.12	0.40	0.42	45	45	2700
比較例11	950	0.09	0.12	−	−	−	−	−
比較例12	950	0.00	0.15	0.41	0.44	40	40	−
比較例13	950	0.03	0.15	−	−	−	−	−
比較例14	950	0.06	0.15	−	−	−	−	−
比較例15	900	0.09	0.15	−	−	−	−	−

[0020] The thing from which a transformer property serves as max in the value of a b each about the value of c and d, and the thing which cannot measure a transformer property write only that from which kp serves as max. In front Naka, the value of six of the examples 1-b of a comparison is too small, and its burning temperature is as high as 1250 degrees C. The value of 12 of the examples 1, 6, 8, 10, anda of a comparison is too small, the value of mechanical Q (= Qm) of a piezo-electric property is small, and the effective thing as a transformer property is not obtained. Furthermore, since the example 9 of a comparison has the too large value of a+b, the same effective transformer property is not chosen. No matter what value [of c and d] it might furthermore take in the examples 11, 14, and 15 of a comparison, the presentation which shows piezoelectric was not acquired. the examples 7, 9, 12, and 13 of a comparison -- also setting -- a and b -- since each value is too large, a transformer property is bad.

[0021] Although the best transformer property was chosen in a= 0.06 of an example 5, b= 0.09, c= 0.41, and d= 0.44 in this experiment, a sufficiently effective transformer property is acquired also in other examples. Therefore, each value of a, b, c, and d is 0.03<=a<=0.09, 0.06<=b<=0.12, and the presentation as a piezoelectric transformer of a laminating mold with effective within the limits of a+b<=18.

[0022]

[Effect of the Invention] In case it is used as a piezoelectric transformer above since burning temperature can be made low by using the presentation of this invention so that clearly from explanation, cheap Ag-Pd can be used for an electrode.